RQ19-45

1. Research Title: System Engineering for Energy and Power Integration Coupled with Validation Testing

2. Individual Sponsor:

Dr. Kirk Yerkes
AFRL/RQQI
1950 5th Street
WPAFB, OH 45433-7251
kirk.yerkes@us.af.mil

3. Academic Area/Field and Education Level

Aerospace Engineering, Mechanical Engineering, and Electrical Engineering, Mathematics/Statistics, Physics (MS or PhD level)

4. **Objectives:**

1. Aerospace vehicle level dynamical mechanical-electrical-thermal system integration analysis and performance testing for current and future high-power and high-energy mission loads
2. Development of validation testing design methodologies, analysis tools, and M&S supporting system integration concepts and performance prediction

5. **Description:** When considering legacy, current, and future aircraft, operation and future capability are limited with respect to an available energy and power management capacity. Subsequently, the power, electrical distribution, and thermal management backbone capacity limits the extensity to achieve maximum performance over the extended life-time. Rational approaches to energy, power, and thermal management model-based engineering coupled with growth management are needed to effectively assess the feasibility of potential upgrades, subsequent capability margins for future operations, and future vehicle definition. These approaches are also expected to define life-cycle operational support requirements for future high-power and high-energy aircraft architectures. As a demonstration of coupled model-based engineering and growth management, well posed modeling and simulation (M&S) and validation testing can be exploited with a view toward evaluation of the performance and growth potential of the electrical system loads. The subsequent impact on the power, electrical distribution, and thermal management backbone coupled to the air vehicle structure and engine can then be assessed. Furthermore, since these backbone components are integrated with electrical system loads and aircraft subsystems, their integration often results a complex interaction of dynamic loads due to pilot action. As a result, system multidisciplinary complexity must be taken into account to properly define and assess energy and power management capability with the consideration of next generation high-power and high-energy vehicles.

6. **Research Classification/Restrictions:** Unclassified/None

8. **Eligible Research Institutions:**

[redacted] **DAGSI** (All DAGSI Universities).

Distribution A – Public Release (88ABW-2018-3543)